

Passive Face Recognition For Immigration Exit

Satisfying System-Level Constraints

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Biometric Exit : Constraints on Solutions

Technical

- » Accuracy (FRR, FTE)
- » Capture, transaction time
- » Network transmission time
- » Backend processing time

Organizational

- » Impact on carrier IT
- » Impact on carrier staff
- » Impact on boarding
- » Impact on travelers
 - In-scope
 - Out-of-scope

DHS + Policy

- » Entry requirements
- » Collection and recognition on US Citizens + ex-scope travelers
- » Capital cost
- » Transactional cost
- » Specifying requirements is difficult
- » Procurement risk

Influential variables

- » Modality selection
- » Number of fingers, eyes, images
- » Sensor, matcher selection
- » Human factors design
- » Real time response + recapture

Influential variables

- » Boarding pass modification
- » Interfaces, common use
- » Boarding process
- » Physical space

Influential variables

- » 1:1 with token, or 1:N without
- » Modality already available from visa or Entry record?

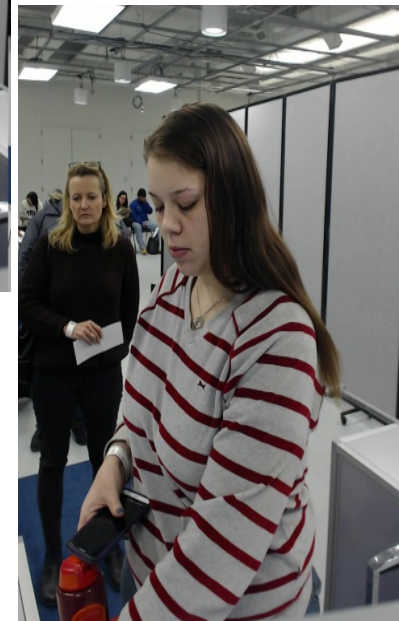
Passive Face Collection + Matching

Case Study 1 of 2: Self-boarding Gate

Passive face collection requires no traveler interaction with airline systems:

- ❑ No delays over existing process
- ❑ No (explicit) connection between airline + DHS systems
- ❑ Traveler paused to look at instructional monitor
- ❑ Passive face collection using webcam

Self-Boarding Gate: Face capture is passive, without cooperation or awareness of traveler



Conclusions: No-Delay Face at Self-Boarding Gate

Performance results	Caveats + comparison to other CONOPs
<ul style="list-style-type: none"> » High level of accuracy achievable, highly dependent on placement of camera and attractor » Low transaction times, minimal if any impact to current boarding times » Video frames verified against prior visa or Entry image 	<ul style="list-style-type: none"> » Video data is larger than fingerprints, iris <ul style="list-style-type: none"> • Payload = 5.4MB (mean per person) • Finger = 10KB, Slap = 120KB • Iris = 30KB » Face recognition algorithm selection is critical <ul style="list-style-type: none"> • Degradation from 1st to 2nd best » Dependent on high quality enrollment sample from Entry, visa or passport image

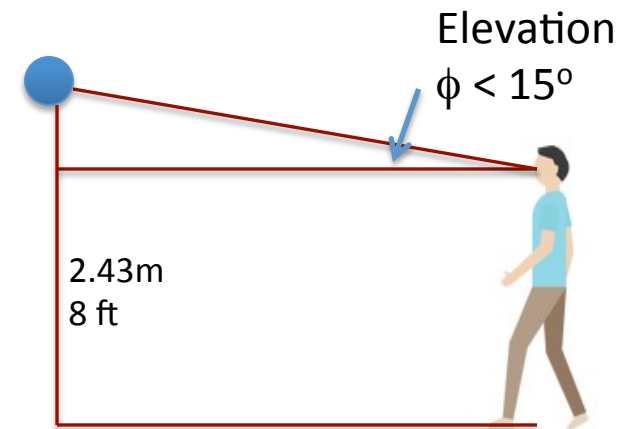
Passive Face Collection + Matching

Case Study 2 of 2: Passenger Loading Bridge

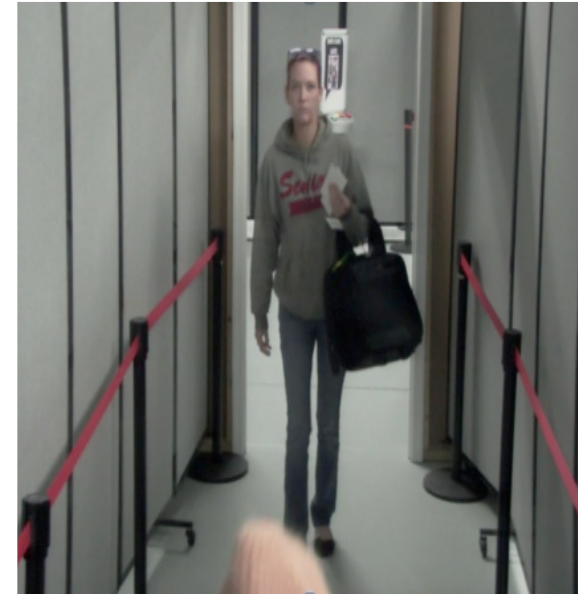
Passive face collection requires no explicit traveler interaction with airline systems:

- ❑ No delays over existing process
- ❑ No connection between airline and DHS systems
- ❑ Interaction with DHS face cameras is non-cooperative

Passenger Loading Bridge: Surveillance mode capture



Passenger loading bridge: Example frames from video



Video vs. Frontal Stills

Population ~ 40

Duration ~ 15 mins, single clip

Pitch ~ 15° at 2 meters. Peak IOD ~ 70
pix.



Passenger loading bridge: Accuracy and computation speed

Performance results

- » Exit confirmation impeded by:
 - Lack of visual attractor
 - Webcam enrollment images
 - Duration in view
 - Hats, cellphones
 - Weak matching algorithms
- » Significant CPU processing time per person, amplified if PLB line is stalled
- » Video stream size is 4GB for time it takes to board 350 person aircraft.

Caveats + comparison to other CONOPs

- » Accuracy below
 - The 97% congressional requirement
 - That from single finger, iris, or passive face at self-boarding gate
- » Biometric recognition processing duration is x100 slower
 - Template generation slow
 - 1:N comparison time is negligible
- » Video payloads are larger than other biometrics. Per person:
 - 1500 times larger than single finger
 - 100 times larger than slap fingers

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Homeland Security

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Thank You

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